



ORIGINAL ARTICLE

An evaluation of mental health and emotion regulation experienced by undergraduate nursing students in China during the COVID-19 pandemic: A cross-sectional study

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ABSTRACT: The COVID-19 outbreak negatively impacted the mental health and emotions of many individuals. The study presented here explores the mental health and emotion regulation experienced by undergraduate nursing students in China during the pandemic. Potential risk factors related to negative mental health symptoms were identified in this study. An online cross-sectional study including 342 respondents was performed from March 6, 2020, to April 1, 2020, at a University in China. A Generalized Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9), and Emotion Regulation Questionnaire (ERQ) were used to evaluate mental health and emotions. The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 22. The prevalence of anxiety, depression, or comorbid anxiety and depression were 55.0%, 56.4%, and 31.6%, respectively. The mean score of cognitive reappraisal and expressive suppression was 29.36 ± 8.00 and 15.55 ± 5.14 . Lower scores for cognitive reappraisal and higher scores for expressive suppression were susceptible to symptoms of anxiety, depression, or comorbid anxiety and depression. Issues with mental health occurred in nursing students during the COVID-19 pandemic. Findings from this study provide a better understanding of the association between mental health and emotion regulation, which will help direct psychological intervention that relieves these issues during the pandemic.

KEY WORDS: anxiety, COVID-19, depression, emotion regulation, nursing students.

BACKGROUND

By late December 2019, a virus known as the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) resulted in coronavirus disease-2019 (COVID-19) broke out in Wuhan and spread in China (Zhu *et al.*, 2020). The National Health Commission of China

reported that the number of confirmed COVID-19 cases in the China mainland was 89,871 by February 24, 2021 (National Health Commission of the People's Republic of China, 2021). China controlled the spread of the pandemic within its country, but it now rapidly spreading worldwide. According to the World Health Organization, as of February 24, 2021, there were 111 762 965 confirmed COVID-19 cases, including 2 479 678 deaths in 223 countries, areas or territories worldwide (World Health Organization, 2021). The virus spreads through respiratory droplets and close contact, making most individuals susceptible. In view of transmission routes and susceptibility, many cities in China restricted travel and it was recommended to stay at home and reduce gatherings. For example,

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Declaration of conflict of interest: No potential conflict of interest was reported by the authors.

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Accepted March 14 2021.

confinement measures such as closing certain businesses and delaying school openings were implemented. Due to the COVID-19 outbreak, all universities postponed the start of the spring semester. Therefore, the traditional campus-based nursing educational mode was changed, and online teaching has since become the primary teaching method (Dutta *et al.*, 2021). In addition, interns left the hospitals, and clinical practice was suspended (Rose, 2020). Quarantine is considered as an effective method to prevent infection but is associated with negative psychological effects such as post-traumatic stress symptoms and confusion, which should not be ignored (Brooks *et al.*, 2020).

Before the COVID-19 outbreak occurred, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) were two other viruses that spread worldwide. Most individuals contracting these diseases did not appear to suffer from mental illnesses; however, depressed moods, anxiety, impaired memory, or insomnia were shown among some individuals in the previous pandemic (Rogers *et al.*, 2020). Recent work studying a variety of populations including frontline healthcare workers, the general population, or students demonstrated that the prevalence of mental health issues was high during COVID-19 (Cao *et al.*, 2020; Shi *et al.*, 2020; Xiao *et al.*, 2020). A large Chinese cross-sectional study found that individuals who have confirmed or suspected COVID-19 had a risk of occupational exposure and who lived in Hubei province showed a greater risk for anxiety, depression, and insomnia (Shi *et al.*, 2020). Most surveys were performed during the pandemic to explore the relationship between epidemic-related characteristics and mental health issues. However, emotion regulation dysfunction is also connected with depression and anxiety (Young *et al.*, 2019). Emotion regulation is where the frequency, intensity, and duration of emotions are upregulated, downregulated, or remain unchanged during a period of time (Gross, 2015a). Emotion regulation strategies refer to specific methods people use to manage their emotions (Koole, 2009). In Gross's Emotion Regulation Model, strategies broadly fall into two categories including antecedent-focused and response-focused emotions. Cognitive reappraisal is a type of antecedent-focused emotion regulation strategy and involves redefining the meaning of an emotion-eliciting situation to modify its potential significance before an emotional response is fully generated. In contrast, expressive suppression belongs to a response-focused emotion regulation strategy, which includes the use of

inhibitory behavioural expression in response to emotionally stimulating events (Gross & John, 2003). Expressive suppression and cognitive reappraisal are common emotion regulation strategies, and there are plenty of studies detecting the relationship between these strategies and psychological problems. Most studies found a greater cognitive reappraisal as always being related to greater psychological well-being and fewer mental health issues (Cludius *et al.*, 2020). On the other hand, the relationship between expressive suppression and psychological symptoms is the opposite (Cameron & Overall, 2018). However, there is limited and mixed evidence regarding emotion regulation and its use in the development of psychopathology (Cludius *et al.*, 2020). Emotion regulation changes at every stage of life. Early adulthood is an important period for development of habit and ability to regulate emotions in later adulthood (Gross, 2015b). College students are considered as early adults and coinciding with the COVID-19 outbreak, their emotional regulation and mental health status garnered attention. To the best of our knowledge, there are no studies focused on the emotional regulation and its relationship with mental health issues in nursing students during the COVID-19 outbreak.

An evaluation of the psychological status and emotion regulation strategy of nursing students will help provide strategies for targeted psychological intervention during the pandemic, prompting the development of medical and health public services. This online cross-sectional study investigated the prevalence of anxiety, depression, or comorbid anxiety and depression, as well as the status of emotion regulation in undergraduate nursing students studying in China during COVID-19. The potential risk factors associated with mental health issues were also evaluated.

METHODS

This online cross-sectional study was conducted from March 6, 2020, to April 1, 2020, using anonymous electronic questionnaires. The questionnaires were edited by the 'questionnaire star' application, and a link was generated. The survey link was sent to Tencent QQ and WeChat groups so participants answered the questionnaire through clicking the link.

The target population consisted of undergraduate nursing students studying at the Nanjing University of Chinese Medicine. The sample size was determined by using single population proportion formula. The prevalence of depression symptom (21.16%) was taken from

a previous literature among Chinese college student during the COVID-19 outbreak (Chang *et al.*, 2020). The standard normal deviation at 95% confidence level of $Z_{\alpha/2} = 1.96$. Margin of error = 5%. The minimum sample size was found to be 256. A convenience sampling design was implemented in this study. A total of 342 nursing students participated in the survey. At the beginning of the questionnaire, there was an explanation about how this study was voluntary.

The questionnaire consisted of three sections. The first section collected demographic information about the respondents, such as age, grade, and location. The second section consisted of epidemic-related questions. The third section included three structured scales including Chinese versions of the Generalized Anxiety Disorder-7 (GAD-7), Patient Health Questionnaire-9 (PHQ-9), and Emotion Regulation Questionnaire (ERQ).

Generalized Anxiety Disorder-7 measured the self-reported frequency of anxiety symptoms. Four included a scale of 0 (not at all) to 3 (nearly every day). The total score of the scale was 0 to 21. According to anxiety severity, the total score was divided into four grades as follows: asymptomatic (0–4), mild (5–9), moderate (10–14), and severe (15–21) anxiety. The Cronbach's alpha was 0.898. The test–retest reliability was 0.856 (He *et al.*, 2010). A cut-off score of 5 was used to detect anxiety symptoms.

Depression was assessed using PHQ-9, which evaluated frequency of depression symptoms in the past two weeks. The total score ranged from 0 to 27. Each item had four options where 0 = 'not at all', 1 = 'several days', 2 = 'more than half the days', and 3 = 'nearly every day'. The scores for symptom severity were 0 to 4 for asymptomatic, 5 to 9 for mild, 10 to 14 for moderate, 15 to 19 for moderately severe, and 20 to 27 for severe. The internal consistency and concurrent validity of the Chinese version PHQ-9 were 0.854 and 0.790, respectively (Zhang *et al.*, 2013). The cut-off score of PHQ-9 used was 5.

ERQ included a 10-item scale used to assess the emotion regulatory process. The scale contained two subscales of cognitive reappraisal (six items) and expressive suppression (four items). Each item was on a seven-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher mean scores in the subscale indicate greater use of a specific emotion regulation strategy. The internal consistency reliability and test–retest reliability were 0.85 and 0.82 for cognitive reappraisal and 0.77 and 0.79 for expressive suppression (Wang *et al.*, 2017).

The authors declare that all procedures contributing to this study comply with the Helsinki Declaration as

revised in 2013 and the ethical standards of the relevant national and institutional committees on human experimentation. Study approval was obtained from the institutional review board at the university. An electronic informed consent form has been displayed to the participants, and after giving consent would they be able to submit the study questionnaires.

The statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 22 (SPSS, Inc, Chicago, IL, USA). Continuous variables were presented as mean or median \pm standard deviations. Categorical variables were presented by percentage. Chi-square tests were used to compare the prevalence of three mental health outcomes in different populations. *T*-tests were used to compare continuous variables between groups. Unadjusted logistic regression analysis was utilized to examine potential factors associated with the three mental health outcomes, with a significant *P*-value < 0.1 . Based on prior studies, living area and whether an individual lived with family members were both determined potential factors. All potential factors were studied using multivariable logistic regression analyses. The results from logistic regression were presented as odd ratios (ORs) and 95% confidence intervals (CIs). The level of significance was set at a *P*-value < 0.05 .

RESULTS

Demographic characteristics

This online cross-sectional study included 342 respondents in the final analysis. 86.8% of respondents were female, and the mean age was 20.72 ± 1.39 years from four separate grades. Most respondents (99.7%) lived outside Hubei province, and 112 (32.7%) lived in the rural area. Of the participants, 335 (98.0%) lived with family members. Most respondents have not visited Hubei province in 2 months (98.8%), were worried about the pandemic (88.6%), or were worried about themselves or family members being infected (85.1%). A total of 314 (91.8%) respondents reported that their lives and studies were affected by the pandemic (Table 1).

Prevalence and severity of anxiety, depression or comorbid

The prevalence of anxiety symptoms, depression, or comorbid anxiety and depression was 55.0%, 56.4% and 31.6%, respectively. 36.5% of respondents had

TABLE 1 Characteristics of respondents (N = 342)

Characteristic	N (%) or mean \pm SD
Age (year)	20.73 \pm 1.39
Gender	
Male	45 (13.2)
Female	297 (86.8)
Grade	
1st year	68 (19.9)
2nd year	41 (12.0)
3rd year	165 (48.2)
4th year	68 (19.9)
Living area	
City	111 (32.5)
Town	119 (34.8)
Rural area	112 (32.7)
Location	
Hubei province	1 (0.3)
Outside Hubei province	341 (99.7)
Live with family members	
Yes	335 (98.0)
No	7 (2.0)
Visit to Hubei province in 2 months	
Yes	4 (1.2)
No	338 (98.8)
Family members or friends been infected with COVID-19	
Yes	3 (0.9)
No	339 (99.1)
Worried about the development of the pandemic	
Yes	303 (88.6)
No	39 (11.4)
Worried about yourself or your family members being infected	
Yes	291 (85.1)
No	51 (14.9)
The pandemic affects your life and study	
Yes	314 (91.8)
No	28 (8.2)
GAD-7	
Asymptomatic (0–4)	154 (45.0)
Mild (5–9)	125 (36.5)
Moderate (10–14)	58 (17.0)
Severe (15–21)	5 (1.5)
PHQ-9	
Asymptomatic (0–4)	149 (43.6)
Mild (5–9)	125 (36.5)
Moderate (10–14)	40 (11.7)
Moderately severe (15–19)	26 (7.6)
Severe (20–27)	2 (0.6)
Comorbid anxiety and depression	
GAD-7 \geq 5 and PHQ-9 \geq 5	108 (31.6)
ERQ	
Reappraisal	29.36 \pm 8.00
Expressive suppression	15.55 \pm 5.14

mild anxiety, 17.0% had moderate, and 18.5% showed severe anxiety. Among respondents who showed signs of depression, 36.5% had mild depression, 11.7%

moderate, 7.6% moderately severe, and 0.6% severe (Table 1). The prevalence of anxiety was high among respondents who were worried about development of the pandemic (57.1% vs 38.5%; $P = 0.028$) or worried about being infected (57.4% vs 41.3%; $P = 0.032$) and reported that the pandemic affected their lives and studies (56.7% vs 35.7%; $P = 0.033$). Respondents who reported the pandemic affected their lives and studies also showed a high prevalence for comorbid anxiety and depression (33.4% vs 10.7%; $P = 0.013$). There were no significant differences based on gender, grade, and living areas. Mental health issues were also not affected by whether they were living with family members or visiting the Hubei province in 2 months (Table 2).

The mean of cognitive reappraisal and expressive suppression in total respondents was 29.36 ± 8.00 and 15.55 ± 5.14 , respectively. There were significant decreases in cognitive reappraisal and increased expressive suppression among respondents with anxiety, depression, or comorbidities ($P < 0.001$).

Factors associated with anxiety, depression, or comorbid

Table 3 presents an unadjusted logistic regression analysis. In the multivariable logistic analysis, older respondents showed a greater risk for anxiety symptoms (AOR: 1.18; 95%CI: 1.00–1.39; $P = 0.048$). Lower scores of cognitive reappraisal were linked to anxiety symptoms (AOR: 0.96; 95%CI: 0.93–0.99; $P = 0.023$), depression (AOR: 0.93; 95%CI: 0.90–0.96; $P = 0.000$), or comorbid (AOR: 0.95; 95%CI: 0.92–0.98; $P = 0.004$). Higher scores of expressive suppression demonstrated greater anxiety (AOR: 1.06; 95%CI: 1.01–1.12; $P = 0.023$), depression (AOR: 1.07; 95%CI: 1.01–1.12; $P = 0.013$), or comorbid (AOR: 1.11; 95%CI: 1.04–1.17; $P = 0.001$) (Table 4).

DISCUSSION

Results of this study indicated mental health issues were widespread among nursing students. An Israeli study analysing 244 nursing students showed that the prevalence of moderate and severe anxiety was 42.8% and 13.1% during the COVID-19, respectively (Savitsky *et al.*, 2020). Compared with the Israeli study, the prevalence of anxiety symptoms in this study appeared to be lower. None of the present study respondents has children, but a certain percentage of respondents in the Israeli study are parents. People who have

TABLE 2 Prevalence of mental health issues stratified by factors

	Anxiety			Depression			Comorbid anxiety and depression		
	Respondents, N (%)			Respondents, N (%)			Respondents, N (%)		
	Asymptomatic	Mild to severe	t/χ^2 P	Asymptomatic	Mild to severe	t/χ^2 P	Asymptomatic	Mild to severe	t/χ^2 P
Overall	154 (45.0)	188 (55.0)		149 (43.6)	193 (56.4)		234 (68.4)	108 (31.6)	
Age (year)	20.57 ± 1.33	20.86 ± 1.42	−1.938 0.053	20.72 ± 1.57	20.73 ± 1.24	−0.080 0.937	20.69 ± 1.46	20.80 ± 1.24	−0.643 0.521
Gender									
Male	24 (53.3)	21 (46.7)	1.444 0.230	16 (35.6)	29 (64.4)	1.353 0.245	32 (71.1)	13 (28.9)	0.174 0.677
Female	130 (43.8)	167 (56.2)		133 (44.8)	164 (55.2)		202 (68.0)	95 (32.0)	
Grade									
1st year	30 (44.1)	38 (55.9)	7.795 0.050	35 (51.5)	33 (48.5)	3.373 0.338	49 (72.1)	19 (27.9)	2.957 0.398
2nd year	24 (58.5)	17 (41.5)		20 (48.8)	21 (51.2)		30 (28.1)	11 (26.8)	
3rd year	78 (47.3)	87 (52.7)		65 (39.4)	100 (60.6)		114 (69.1)	51 (30.9)	
4th year	22 (32.4)	46 (67.6)		29 (42.6)	39 (57.4)		41 (60.3)	27 (39.7)	
Living area									
City	56 (50.5)	55 (49.5)	2.112 0.348	42 (37.8)	69 (62.2)	2.778 0.249	74 (66.7)	37 (33.3)	0.261 0.878
Town	52 (43.7)	67 (56.3)		58 (48.7)	61 (51.3)		83 (69.7)	36 (30.3)	
Rural area	46 (41.1)	66 (58.9)		49 (43.8)	63 (56.2)		77 (68.8)	35 (31.2)	
Live with family members									
Yes	152 (45.4)	183 (54.6)	0.782 0.377	146 (43.6)	189 (56.4)	<0.001 0.999	230 (68.7)	105 (31.3)	0.057 0.812
No	2 (28.6)	5 (71.4)		3 (42.9)	4 (57.1)		4 (57.1)	3 (42.9)	
Visit to Hubei province in 2 months									
Yes	1 (25.0)	3 (75.0)	0.093 0.761	3 (75.0)	1 (25.0)	0.590 0.442	3 (75.0)	1 (25.0)	<0.001 0.999
No	153 (45.3)	185 (54.7)		146 (43.2)	192 (56.8)		231 (68.3)	107 (31.7)	
Worried about the development of the pandemic									
Yes	130 (42.9)	173 (57.1)	4.847 0.028	131 (43.2)	172 (56.8)	0.120 0.729	202 (66.7)	101 (33.3)	3.785 0.052
No	24 (61.5)	15 (38.5)		18 (46.2)	21 (53.8)		32 (82.1)	7 (17.9)	
Worried about yourself or your family members being infected									
Yes	124 (42.6)	167 (57.4)	4.608 0.032	129 (44.3)	162 (55.7)	0.462 0.497	194 (66.7)	97 (33.3)	2.780 0.095
No	30 (58.8)	21 (41.2)		20 (39.2)	31 (60.8)		40 (78.4)	11 (21.6)	
The pandemic affects your life and study									
Yes	136 (43.3)	178 (56.7)	4.569 0.033	133 (42.4)	181 (57.6)	2.286 0.131	209 (66.6)	105 (33.4)	6.145 0.013
No	18 (64.3)	10 (35.7)		16 (57.1)	12 (42.9)		25 (89.3)	3 (10.7)	
ERQ									
Reappraisal	31.13 ± 7.45	27.72 ± 8.13	4.025 <0.001	31.89 ± 5.364	27.23 ± 8.93	5.878 <0.001	30.89 ± 6.81	25.74 ± 9.20	5.189 <0.001
Expressive suppression	14.36 ± 5.05	16.52 ± 5.02	−3.933 <0.001	14.15 ± 4.90	16.63 ± 5.07	−4.568 <0.001	14.50 ± 4.90	17.81 ± 4.95	−5.776 <0.001

TABLE 3 Unadjusted regression analysis of risk factors for symptoms of mental health

	Anxiety		Depression		Comorbid anxiety and depression	
	OR (95%CI)	P	OR (95%CI)	P	OR (95%CI)	P
Age (year)	1.17 (1.00–1.37)	0.055	1.01 (0.86–1.17)	0.934	1.06 (0.90–1.24)	0.520
Gender						
Male	1		1		1	
Female	1.47 (0.78–2.75)	0.231	0.68 (0.36–1.31)	0.247	1.16 (0.58–2.31)	0.677
Grade						
1st year	1		1		1	
2nd year	0.56 (0.26–1.23)	0.146	1.11 (0.51–2.42)	0.786	0.95 (0.40–2.26)	0.900
3rd year	0.88 (0.50–1.55)	0.661	1.63 (0.92–2.88)	0.092	1.15 (0.62–2.15)	0.653
4th year	1.65 (0.82–3.32)	0.159	1.43 (0.73–2.80)	0.303	1.70 (0.83–3.49)	0.149
Living area						
City	1		1		1	
Town	1.31 (0.78–2.21)	0.306	0.64 (0.37–1.08)	0.096	0.87 (0.50–1.51)	0.616
Rural area	1.46 (0.86–2.48)	0.160	0.78 (0.46–1.34)	0.369	0.91 (0.52–1.59)	0.739
Live with family members						
Yes	0.48 (0.09–2.52)	0.387	0.97 (0.21–4.41)	0.969	0.61 (0.13–2.77)	0.521
No	1		1		1	
Visit to Hubei province in 2 months						
Yes	2.48 (0.26–24.09)	0.433	0.25 (0.03–2.46)	0.237	0.72 (0.07–7.00)	0.777
No	1		1		1	
Worried about the development of the pandemic						
Yes	2.13 (1.07–4.22)	0.030	1.13 (0.58–2.20)	0.729	2.29 (0.98–5.36)	0.057
No	1		1		1	
Worried about yourself or your family members being infected						
Yes	1.92 (1.05–3.52)	0.034	0.81 (0.44–1.49)	0.497	1.82 (0.89–3.70)	0.099
No	1		1		1	
The pandemic affects your life and study						
Yes	2.36 (1.05–5.27)	0.037	1.82 (0.83–3.96)	0.135	4.19 (1.24–14.19)	0.021
No	1		1		1	
ERQ						
Reappraisal	0.94 (0.91–0.97)	<0.001	0.92 (0.88–0.95)	<0.001	0.92 (0.90–0.95)	<0.001
Expressive suppression	1.09 (1.04–1.14)	<0.001	1.11 (1.06–1.16)	<0.001	1.15 (1.09–1.21)	<0.001

children experienced high anxiety during the pandemic. Therefore, the parental status may be the reason for the difference (C. Fong & Iarocci, 2020; Taubman-Ben-Ari & Ben-Yaakov, 2020). Another Chinese study including respondents from 18 to 68 years old showed that individuals in the age 18 to 24 age group showed the greatest risk for developing anxiety (Lin *et al.*, 2020), which is consistent with the present research. Young adults spend more time and energy on various social media, and the information on social media is complicated to interpret and process, which may lead to an increased risk of psychological problems (Barthorpe *et al.*, 2020; The Lancet, 2019). Another study included 8079 Chinese students ranging from 12 to 18 years of age during the COVID-19 pandemic and revealed that the prevalence of anxiety and depression were 37.4% and 43.7%, respectively (Zhou *et al.*,

2020). Compared with younger individuals, most respondents over 60 years of age showed no anxiety or depression symptoms, according to a Spanish study (Gorrochategi *et al.*, 2020). Recently, a large-scale online survey including a Chinese adult population showed that the rate for anxiety was 31.6% and the rate for depression was 27.9% (Shi *et al.*, 2020). Depression and anxiety are mental health issues that do not discriminate by age, but their prevalence varies, and undergraduate students are susceptible. Different fields of study pursued by undergraduate students influences the prevalence of mental health issues. Naser *et al.* (2020) found that the rate of anxiety symptoms was 21.5% and the rate of depression was 35.8% in university students. The study population contained 46.7% medical students and more than half of the population studies in different fields (Naser *et al.*, 2020). A

TABLE 4 Multivariable regression analysis of risk factors for mental health issues

	Anxiety		Depression		Comorbid anxiety and depression	
	AOR (95%CI)	P	AOR (95%CI)	P	AOR (95%CI)	P
Age (year)	1.18 (1.00–1.39)	0.048	–	–	–	–
Reappraisal	0.96 (0.93–0.99)	0.023	0.93 (0.90–0.96)	<0.001	0.95 (0.92–0.98)	0.004
Expressive suppression	1.06 (1.01–1.12)	0.023	1.07 (1.01–1.12)	0.013	1.11 (1.04–1.17)	0.001

study performed by Liu *et al.* (2020) showed that the prevalence of anxiety and depression was 22.1% and 35.5%, respectively in medical students. However, this study did not clarify the specific fields of study. This study demonstrated that nursing students showed a higher prevalence of mental health issues compared with these prior studies. On the one hand, nursing students have more knowledge about the pandemic and can perceive potential exposure risks and serious consequences. Despite the dangers of frontline work, a previous study indicated that most nursing students were still willing to engage in infectious disease care (Patel *et al.*, 2017). On the other hand, most students reported that the pandemic affected their normal medical educations and daily lives. These sudden shocks may cause an increased risk of mental health symptoms (Harries *et al.*, 2021). Due to the nursing profession's specificity, most of the students in our school of nursing were female, so only 13.2% of the respondents included in this study were male. Nevertheless, this study did not detect the impact of gender on mental health symptoms, indicating that both males and females were anxious about the pandemic. The result was in accordance with another study involving nursing students (Patelarou *et al.*, 2021).

Anxiety and depression often coexist and the symptoms are more severe than when either of these occur alone. The rate of comorbid anxiety and depression symptoms was 31.6% in this study. This result supports previous work that comorbid are common in adolescents and university students during the COVID-19 outbreak (Zhou *et al.*, 2020). It is now well established that comorbid anxiety and depression is associated with poor family function, severe social anxiety, negative moods and self-esteem issues (Cummings *et al.*, 2014; O'Neil *et al.*, 2010). Timely assessment and monitoring as well as appropriate psychological interventions are of significance to prevent and improve mental health issues in nursing students.

Most nursing students in this study ranged from 18 to 24 years old, covering four grades. The older age

the student, the higher the grade. Although there is no statistically significant difference in grades, the proportion of seniors with anxiety symptoms is increased compared with younger students. Seniors have completed the theoretical study of nursing and have practised as interns in hospitals for about 9 months. They have experienced the pressure and fast pace of clinical work. In addition, due to the impact of the pandemic, the employment situation was severe and employment pressure increased significantly. As an intern about to graduate and become a professional nurse, employment pressure and uncertainty related to the pandemic caused nursing students to experience mental health issues.

Results revealed that nursing students with mental health issues showed less frequent use of cognitive reappraisal. Low cognitive reappraisal was also a risk factor for anxiety, depression, or comorbid in nursing students. These results are consistent with an American study (D'Avanzato *et al.*, 2013). Individuals use emotion regulation strategies consistent with their emotion preferences. Although most tend to report preferences for positive emotions over negative ones, individuals with depression are less likely to choose positive emotions (Millgram *et al.*, 2019). In a recent study, participants reported their preference for positive emotions and accomplished a task related to emotion regulation. They were given choices to use cognitive reappraisal. People with depression were more willing to use reappraisal to down-regulate positive emotions (Millgram *et al.*, 2019). Nevertheless, a study including young adults with or without major depressive disorder showed that cognitive reappraisal did not differ between the two groups (Ellis *et al.*, 2013). Conclusions formulated using laboratory stimuli are inconsistent with this study. Laboratory stimuli differ from real-life events and are likely to be less emotionally intense compared with a real life setting (Liu & Thompson, 2017). Moreover, laboratory stimuli are not closely related to the participants themselves. Reduced relevance may also affect the process of cognitive

reappraisal. In the study presented here, most nursing students reported that the pandemic affected their daily life. The COVID-19 outbreak is a concern for every individual in multiple aspects and is a real-world public health emergency having a greater negative impact on cognitive reappraisal in students with mental health issues.

Another obvious finding was that high expressive suppression was a risk factor for anxiety, depression or comorbid. This finding was consistent with a previous study carried out in undergraduate students as well (Moore *et al.*, 2008). A meta-analysis including 48 studies showed a significant positive correlation between expressive suppression and negative mental health. In addition, the meta-analysis also found that the correlation between reappraisal and negative mental health was stronger than the correlation between expressive suppression and negative mental health (Hu *et al.*, 2014). Cognitive reappraisal and expression suppression appear in different stages of an emotional response. Expression suppression comes after the entire emotional experience; thus, expression suppression has a relative weaker effect on emotions (Gross & John, 2003). However, high expression suppression is not only related to mental health issues, but also has unintended rebound effects, such as an increase of unwanted thoughts or a reduction of social functions (Gross & John, 2003; Wenzlaff & Luxton, 2003). The study presented here began at the beginning of the school year, but due to the pandemic, students were required to quarantine at home and forbidden to return to school. Since it was uncertain as to when students would return to school, all courses were taught online. It was obvious that the sudden outbreak of COVID-19 disrupted the lifestyles and study plans, as well as restricted the activities and learning methods for the students. In this situation, if there is no proper way to express and modify emotions, long-term inhibition and concealment of these emotions may lead to emotional dysregulation and mental health issues. Current psychological interventions are mostly applied to medical staff (Geoffroy *et al.*, 2020). This study suggested that undergraduate nursing students are also a group in needing attention. Psychological interventions with a focus on emotional regulation strategies may be an effective method to prevent and adjust mental health issues. Even though face-to-face intervention is not possible during this pandemic, psychological support through the Internet and telephone can ensure that students are getting the help that they need.

Strengths and limitations

Some strengths in this study should be mentioned. We believe the results of the study makes a meaningful contribution to the literature during the special period for people all over the world. This study paid close attention to the mental health status of undergraduate nursing students which may improve the recognition of high-risk populations. Moreover, the relationship between emotional regulation strategies and mental health was explored, which providing theoretical basis for development of effective interventions.

There are several limitations associated with this study. First, this study used online social media to recruit participants, which may have resulted in selection bias. Since most participants were located outside of Hubei province, the representativeness of the population was limited. A follow-up study needs to have an increase sample size. Second, signs of mental health illnesses were determined by self-reported analyses instead of professional clinical diagnoses, which can lead to reporting bias. Third, this study used cross-sectional methodology and the causal relationships between mental health symptoms and risk factors could not be established. Despite these limitations, this study provides effective information regarding the status of mental health and emotional regulation, as well as risk factors for undergraduate nursing students in China during the COVID-19 pandemic.

CONCLUSIONS

This study found that the prevalence of anxiety, depression, or comorbid was high in Chinese undergraduate nursing students during the COVID-19 pandemic. Close attention to the mental health of college students is an important aspect during this pandemic. To date, China has COVID-19 under control; meanwhile, other countries around the world are actively fighting to stabilize this disease. The study presented here provides valuable information for others when it comes to understanding the psychological impact of the pandemic on nursing students. Low cognitive reappraisal and high expressive suppression were related to mental health issues. It can be seen that emotion regulation would be one of the strategies of psychological intervention. Future studies should explore the relationship between emotion regulation and mental health in the long term during and after the pandemic.

RELEVANCE FOR CLINICAL PRACTICE

This study has revealed the mental health and emotion regulation experiences of undergraduate nursing students during the early COVID-19 pandemic. Nursing students were more sensitive to the epidemic resulting in mental health problems. Therefore, attentions should be paid to the psychological status of nursing students and timely guidance should be given, especially for interns who are in clinical practice. The result from this study indicated that students' emotional regulation ability will directly affect their mental health. Practical suggestion based on this result is that emotion regulation strategies may be considered as part of a psychological intervention to alleviate mental health symptoms of students. Psychological consultation services can be provided via telephone, chat software, web pages, etc. Moreover, it is also very important to keep monitoring the mental health of nursing students until the end of the epidemic and afterwards.

ACKNOWLEDGEMENTS

None.

ETHICAL APPROVAL

The authors declare that all procedures contributing to this study comply with the Helsinki Declaration as revised in 2013 and the ethical standards of the relevant national and institutional committees on human experimentation.

FUNDING INFORMATION

This work was supported by the Priority Academic Program Development of Jiangsu Higher Education Institutions (No. 2019YSHL027), Qing Lan Project of Nanjing University of Chinese Medicine, Jiangsu Province (No. NZYHLXPPQL2019-10) and Philosophy and Social Science Research of Jiangsu Higher Education Institutions (No. 2020SJA0315).

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